LS Control

Frequency Converter
SpeedControl E 1045
For use with Rotary Compressors

E1045DP

Revision 1.
Aug/2013

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Product Description

SpeedControl E 1045 is a frequency converter for control of EC, PMSM, BLDC and standard asynchronous motors up to 1200W for 3 phase motors with single phase supply.

SpeedControl E 1045 is enclosed in an IP 54 metal housing for demanding environments. The compact construction offers many mounting options. The construction is not equipped with active cooling, the sound level is very low and the frequency converter is maintenance free.

- Descrete light grey color for reduction of heat absorption.
- Silent and reliable with an advanced self protection feature.
- Provided with a user-friendly interface for quick and easy installation.
- Designed for use in many different applications, including pump, ventilator and compressor applications. Depending on motor profile.
- For special applications, please contact us for further information.

Technical Specifications

Supply Voltage	Uin = 230VAC ±10% - 50Hz
Supply Current	Max. Iin = 10A
Motor Voltage	3 x AC - 0 - Uin
Motor Current	Max. 5,0A
Motor Frequency	0 – 300 Hz
16Vdc output	100mA
10Vdc output	30mA
0 – 10V input	0 – 10V, Ri = 7 kOhm.
Alarm Relay	Max. 30Vdc/3A & 230VAC/3A
Operating Temperature	0 – 40°C
Modbus A	Net plus
Modbus B	Net minus
Modbus C	Net GND

EMC

The frequency converter complies with the standard of electrical Power Drive Systems. The frequency converter is classified as a Power Drive System (PDS) of ”category C2” (EN 61800 – 3).

- EN 61800 – 3:2005 – Adjustable speed electrical power drive systems - Part 3: EMC requirements and specific test methods.
- EN 61800 – 3/A1:2012 – Adjustable speed electrical power drive systems - Part 3: EMC requirements and specific test methods.
- EN 61800 – 5 – 1:2007 – Adjustable speed electrical power drive systems - Part 5-1: Safety requirements - Electrical, thermal and energy.

Warnings

Before the frequency converter is taken into use, verify that the frequency converter specifications are compatible with the mains to which it is going to be connected. Furthermore verify that the motor is suitable for frequency converter connection and that it is in compliance with the frequency converter specifications.

Check the place of installation for any special requirements and precautions which must be observed during installation, commissioning or operation. The frequency converter must be supplied through a mains switch with at least 3mm breaker space between all conductors according to IEC364. The fuse installed in the electrical switchboard must be 13A or less. The frequency converter must always be connected to yellow/green grounding conductor (PE) in supply.

If the frequency converter is connected to an installation with a residual current device as an extra protection, the device must be marked with the following symbol: HPFI/PFI

The components of the power unit of the frequency converter are live when it is connected to mains. Coming into contact with this voltage is extremely dangerous and may cause death or severe injury. The control unit (connection 1-15) is isolated from the mains potential.

The motor terminals U, V and W are live when the frequency converter is connected to mains, even when the motor is not running.

The control I / O terminals are isolated from the mains potential (clamps 1 – 15). However, dangerous control voltage may be present at the relay output terminals (9, 10 and 11) even when the frequency converter is disconnected from mains.

The earth leakage current may exceed 3.5 mA AC when the frequency converter is connected to a motor. According to standard EN61800-5-1 a reinforced protective ground connection must be mounted.

If the frequency converter is part of a machine solution, the machine manufacturer is responsible for providing the machine with a main switch. (EN60204-1).

If the frequency converter is disconnected from mains while the motor is running, high and dangerous voltage may still be present on the frequency converter power unit. In this case the motor is operating as a generator supplying the frequency converter with power.

After disconnecting the frequency converter from mains, wait a minimum of 5 minutes before handling the frequency converter.

The frequency converter may automatically start the motor after a fault situation or after reconnection of mains. Note that there might be a minimum downtime during which the motor cannot be stopped.

The frequency converter is sensitive to ESD (ElectroStatic Discharge). Handle with care. ESD may cause damage to the frequency converter.

Description of Functions

Supply

The frequency converter is supplied by 230VAC ±10%. However it is possible to lower the voltage, but it must be noted, that the power of the asynchronous motor will be lowered as the main supply voltage decreases. It is not recommended to use a supply less than 200VAC.

Control Voltage

1 – 10 Vdc = min. rpm – max. rpm (6 phase motor => 200rpm – 1000rpm => 10 – 50 Hz). If control voltage gets lower than 1 Vdc the frequency converter will run min. rpm. The control voltage levels can be adjusted via the Modbus-interface. (See chapter on Modbus).

RUN input

If the RUN input is activated (added to GND from internal supply) the frequency converter will start the motor. The RUN input can be disabled through the Modbus-interface. (See chapter on Modbus).

DIR Input

DIR controls which way the motor will run and it can only be updated/changed when the motor is not running. If the DIR input is activated (added to GND from internal supply) the frequency converter will change direction, but only when the motor is at a stand still.

Alarm Relay

The frequency converter is supplied with an alarm relay which is activated when there are no faults. If the frequency converter has to stop due to severe error, the relay will be deactivated (it changes position). The alarm relay is deactivated when supply is disconnected. The function of the alarm relay can be changed through the Modbus-interface. (See chapter on Modbus).

Current Limits

Current limits can only be adjusted via the Modbus-interface. (See chapter on Modbus). The current limits are as standard set to the current printed on the motor plate. When the frequency converter registers that the current limit is exceeded, it will automatically reduce the speed of the motor. However the speed will never be reduced further than minimum speed. In ACIM the down regulation function can be deactivated and the motor will stop if the current exceeds the current limit. The time delay before the motor stops depends on the current and the overrun time which are integrated into the intelligent protection algorithm in the control.

Temperature

The temperature function is set to ensure that if the frequency converter power unit registers an excess temperature it will reduce the motor speed. However, the speed will never be reduced further than the minimum speed. The motor speed reduction will be slow. Should the temperature continue to increase, inspite of the speed reduction, the frequency converter will stop and indicate error. The temperature reduction function is part of the intelligent protection algorithm. The temperature setting for where the frequency converter should start to reduce the speed can be lowered by means of the Modbus-interface. (See chapter on Modbus).

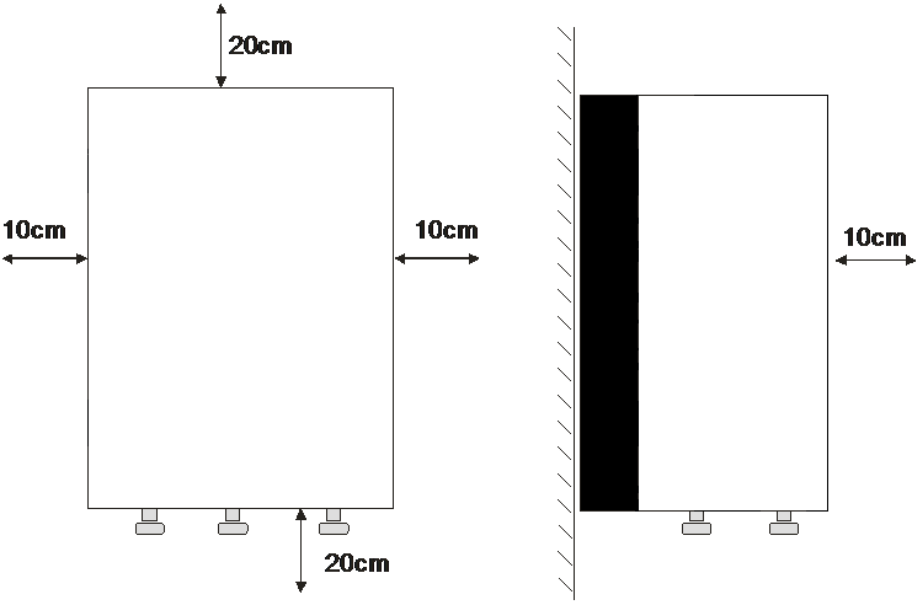
Electrical / Mechanical Installation

Important

A time delay of approx. 3 - 30 sec will occur at start up. If the PCB is dismounted from the metal housing, the warranty will be void. Before handling the frequency converter, it must have been disconnected from supply power for at least 5 min.

Location

The frequency converter is cooled by passiv air circulation. To avoid reduced operation or operating stops due to overheating of the frequency converter, the frequency converter must be mounted vertically on a metal plated wall and the glands facing downwards. The frequency converter must be mounted with space around it to ensure sufficient cooling by allowing free circulation of air. Make sure that the mounting surface can withstand the temperature of the surface of the frequency converter.



The frequency converter must be installed in a well ventilated enviroment. The surrounding temperature must not exceed 40°C and the frequency converter must never be mounted in a location where it is exposed to direct sun light.

Supply

The frequency converter is supplied by mains (230VAC ±10%) with minimum 3 x 1.5 mm2 cable. The distance between supply cable and motor cable must be as long as possible. (> 30 cm). If it is neccessary to cross the power cable and the motor cable, this must be done at an angle of 90°. The PE-conducter from the motor, which is screwed into the terminal block, must be longer than L and N. The fuse installed in the electrical switchboard must be 13A or less.

Due to relatively high leakage currents in the frequency converter and the motor, the frequency converter and the motor must always be properly grounded in accordance with national and local regulations. The ground conducter should be as short as possible to avoid high frequency radiation.

Supply Connection

PE	Protective grounding (supply)
N	Neutral (supply)
L	Live (230VAC) (supply)

Motor

The motor is connected to the frequency converter by minimum 4 x 1.5 mm2 shielded cable. The total cable length must not exceed 20 m, keep it as short as possible. Long cables may cause function failure. The motor cable must be shielded and be mounted correctly in the metal gland to minimize electrical noise from the motor. PE conductors must be longer than U, V and W.

Motor Connection

PE	Protective Earthing conductor for motor
U	Motor conductor U
V	Motor conductor V
W	Motor conductor W
Shield	Grounding from gland

Signal Cables

The distance between the signal cable and the motor cable must be as long as possible (> 30 cm). If the sig-nal cable crosses the motor cable, it must be done at an angle of 90°. The cable must be shielded to GND.

Signals

1	GND
2	LSC
3	DIR
4	RUN
5	GND
6	0 - 10V in
7	10Vdc out
8	16,5Vdc out

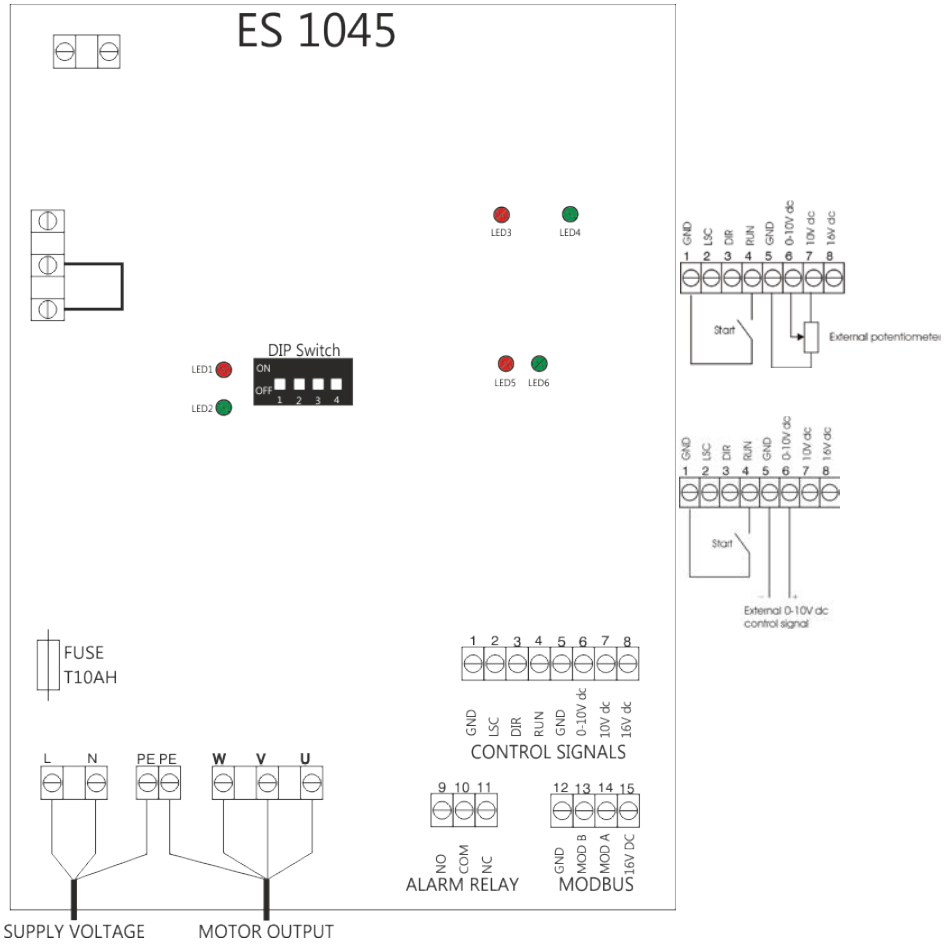
Alarm

9	NO
10	Common
11	NC

Modbus

12	GND
13	Modbus B
14	Modbus A
15	16,5Vdc out

Mounting


ES 1045
LED3
LED4
DIP Switch
ON
OFF
1 2 3 4
LED1
LED2
LED5
LED6
GND
LSC
DIR
RUN
GND
0-10V dc
10V dc
16V dc
1 2 3 4 5 6 7 8
Start
External potentiometer
External 0-10V dc control signal
FUSE
T10AH
CONTROL SIGNALS
L
N
PE PE
W
V
U
SUPPLY VOLTAGE
MOTOR OUTPUT
9 10 11
NO
COM
NC
ALARM RELAY
12 13 14 15
GND
MOD B
MOD A
16V DC
MODBUS

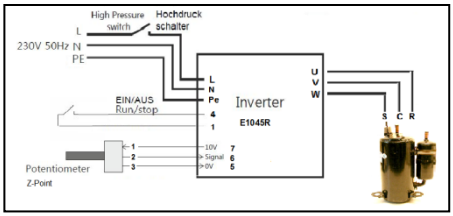
Technische Spezifikation
Technical Specification

Der Inverter E1045 für nachstehende Hitachi Highly Rotary Kompressor getestet und über DIP Schalter einstellbar
The Speed Controller E1045 is for following Hitachi Highly Rotary Compressors tested and via DP-Switches to be setted.

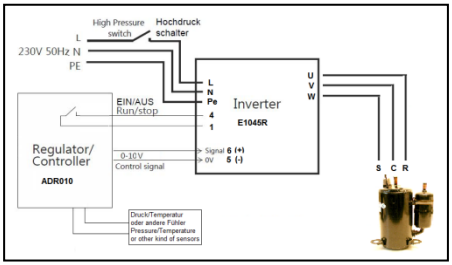
Modell	Refrigerant
ASD084CK	R410A
ASC092CD	R410A
ASD102SF	R410A
ASC104SD	R410A
ÁSG133CDN	R410A
ASG133SDM	R410A
BSA804SD	R134a

Modell	Model	E1045R	E1045DP
Ausführung	Version	Platine/PCB	Gehäuse/Box
Abmessungen	Dimensions	225x115x60 mm	275x175x115 mm
Anschlussspannung	Supply Voltage	Um=230Vac +/- 10%	
Stromaufnahme	Supply Current	Max Lin =10A	
Ausgangsspannung	Output Voltage	3 x AC 0-Um	
Ausgangsstrom	Output current	Max.5A	
Ausgangsfrequenz	Output frequency	53-240Hz	
16 Vdc Ausgang	16 Vdc Output	Max 50 mA	
10 Vdc Ausgang	10 Vdc Output	Max 20 mA	
0-10V Eingang	0-10V Input	0-10 V, Ri = 7 kOhm	
Alarm Relais	Alarm relay	Max 30 Vdc / 6A 230V/6A AC1	
Modbus		A –Net Plus	
Modbus		B – Net Minus	
Modbus		C - Gnd	

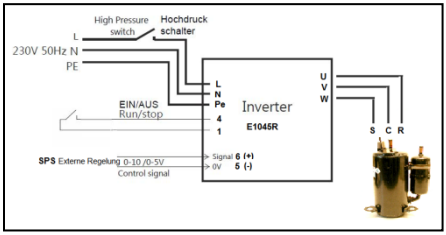
Verdichter-Drehzahlregelung über Potentiometer
Compressor-Speed Control with Potentiometer



Verdichter-Drehzahlregelung externen Regler mit 0-10 V Ausgang (z.B ADR010)
Compressor-Speed Control with external Controller and 0-10V signal (i.e. ADR010)



Verdichter-Drehzahlregelung externe SPS-Regelung 0-10V
Compressor-Speed Control with external Control (SPS) 0-10V



Indicator Lights

The PCB is equipped with a number of LED lights. LED1 to LED6.

Modbus LED lights

LED5 (red) and LED6 (green) are modbus LED lights. See page ”8” for LED locations.
LED6 flashes fast when communicating.
LED5 has no function.

Motor LED lights

LED1 (red) and LED2 (green) are controlled by the circuit regulating the motor.
See page ”8” for LED locations.

Start

When the frequency converter is connected to mains, the following pattern is shown:

1. LED1 is turned off and LED2 is lit constantly => processor initialization
2. After 5 – 10 seconds LED1 flashes a number of times to indicate the motor selected by the DIP switches. This also indicates that the motor in questions has been initialized in the processor.
3. At last LED1 turns off and LED2 starts flashing.

Operation

When there are no errors LED2 will be flashing. LED2 flashes when the motor is running and when it is stopped. This indicates that everything is running normally.

Errors

If an error is detected, the frequency converter will stop the motor, turn on LED1 and turn off LED2.

Controller LED's

LED3 (red) and LED4 (green) are controlled by the interface circuit controlling the I/O's.
See page "8" for LED locations.

Start

When the frequency converter is connected to mains, the following pattern is shown:

1. LED3 turns on and LED4 flashes fast.
2. After 5 – 30 seconds (when the power electronics has been initialized and indicated the motor choice), LED3 will turn off and LED4 will flash slowly.

Operation

When there are no errors LED4 flashes slowly and LED3 is turned off. This pattern is shown both when the motor is stopped or running. It indicates that everything is running normaly.

Restart

When an error is detected and the frequency converter is waiting to restart, LED3 and LED4 will be flashing at the same frequency. When restart is activated, a new start is initialized.

Errors

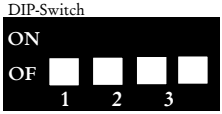
If an error is detected, the circuit will indicate the error by flashing LED3 and turn off LED4. At the same time the modbus registers 03x0009 and 03x0010 will be set to a value corresponding to the error. Modbus-register 03x0011 will be set, if the frequency converter is unable to restart and resume operation.
The following errors will be indicated by LED3 and the modbus registers 03x0009 and 03x0010:

Flash LED3	03x0009 Error code	03x0010 Error code2	Error type Description
1	0	1	Maximum Temperature error. Have not been able to adjust motor, to prevent over temperature.
2	0	2	Motor Start Error. Have not been able to start motor.
3	0	4	Motor current error 1. Current limit exceeded for more than 4 minutes.
4	0	8	Motor current error 2. Current limit x 1,25 exceeded for more than 2 minutes.
5	0	16	Motor current error 3. Current limit x 1,50 exceeded for more than 1 minutes.
6	0	32	Motor current error 4. Current limit x 2,00 exceeded for more than 10 seconds.
7	256	0	Motor gate kill error. High current peak detected.
8	1024	0	Motor phase loss error.
9	2048	0	Motor zero speed error.
10	4096	0	MCE error. This includes: over voltage, undervoltage, regulating error, etc.
11	32768	0	Error Temperature – Thermo protection has cut off or Terminal connection is open
12			
13			

Motor Choice

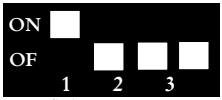
By selecting the DIP switches position 1 to 4 on and off it is possible to choose motor/Compressor. The following positions are available:

Motor 1: BSA804S
DIP-Switch



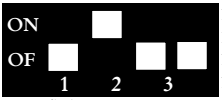
LED1 flashes once.

Motor 2 : ASD084CKM A7JK
DIP-Switch



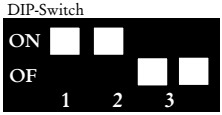
LED1 flashes twice.

Motor 3 : ASC092 CD A7JK
DIP-Switch



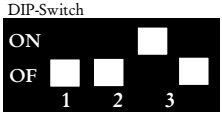
LED1 flashes 3 times.

Motor 4 : ASD102SF A7JT
DIP-Switch



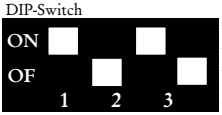
LED1 flashes 4 times.

Motor 5 : ASC104SD A8JT
DIP-Switch



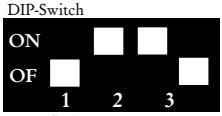
LED1 flashes 5 times.

Motor 6 : ASG133CDN B7AT
DIP-Switch



LED1 flashes 6 times.

Motor 7 : ASG133SDM B7AT
DIP-Switch

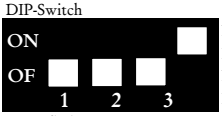


LED1 flashes 7 times.

Motor 8 :
DIP-Switch

LED1 flashes 8 times.

Motor 9 :
DIP-Switch



LED1 flashes 9 times.

All inverter settings are selected so that the compressor can be operated from a predetermined minimum speed up to 6000 rpm. Note that motors can be unstable and difficult to control under very high load and high speed. When this happens, the drive will stop and will report an error. When selecting a compressor make sure that the drive is not connected to the power supply. The compressor must be selected (no LEDs on) just before the start.

More compressors in preparation or on request

Change the preset (default) settings by MODBUS

For more details, please refer to the manual for Multiprogrammer E1045 or the following information about the setting changes via MODBUS (from page 13)

Modbus

With modbus it is possible to adjust parameters and export data. It is also possible to control the motor via modbus by deactivating the 0-10V control signal.

Holding Register

In the holding registers, it is possible to adjust registers inside the control. (With Modbus function 6).

Holding Register Overview

Reg. Adr.	Data beskrivelse	R/W	Lengh	Min.	Max.	Remark
04x0000	Speed setpoint	R/W	16 bit	0	10000	RPM / 0 -100%
04x0001	Speed setpoint Type	R/W	16 bit	0	1	0 = RPM / 1 = 0 - 100%
04x0002	Set direction	R/W	16 bit	0	1	0 = CCW / 1 = CW
04x0003	Minimum speed	R/W	16 bit	100	10000	RPM
04x0004	Maximum speed	R/W	16 bit	100	10000	RPM
04x0005	Ramp up time	R/W	16 bit	10	1000	Seconds.
04x0006	Ramp down time	R/W	16 bit	10	1000	Seconds.
04x0007	Stop or run at min speed	R/W	16 bit	0	1	0 = stop / 1 = run min.
04x0008	External Speed and RUN signal	R/W	16 bit	0	1	0 = not active / 1 = active
04x0009	External min. speed voltage	R/W	16 bit	0	100	Volt. 10 = 1,0V
04x0010	External max. speed voltage	R/W	16 bit	0	100	Volt. 90 = 9,0V
04x0011	External stop voltage.	R/W	16 bit	0	100	Volt. 5 = 0,5V
04x0012	External direction input enabled	R/W	16 bit	0	1	0=Disabled / 1=Enabled (DIR)
04x0013	Relay output function	R/W	16 bit	0	4	See description of holdingregisters
04x0014	Auto restart at error times.	R/W	16 bit	0	50	0 = OFF.
04x0015	Auto restart delay time	R/W	16 bit	10	1000	Seconds.
04x0016	Current limit. Running current.	R/W	16 bit	0	2000	Ampere. 200 = 2,00A
04x0017	Current limit. Starting current.	R/W	16 bit	0	2000	Ampere. 200 = 2,00A (only PMSM)
04x0018	Current limit. Breaking current.	R/W	16 bit	0	2000	Ampere. 200 = 2,00A (only PMSM)
04x0019	Auto speed reduce before current limit	R/W	16 bit	0	1	0 = OFF / 1=ON
04x0020	VHZ_Gain	R/W	16 bit	0	65535	Not in use
04x0021	VHZ_Boost	R/W	16 bit	0	65535	Not in use
04x0022	VHZ_modlim	R/W	16 bit	0	65535	Not in use
04x0023	TempReduceLimit	R/W	16 bit	30	87	°C.
04x0024	Start stop times pr hour	R/W	16 bit	0	20	0 = OFF => no effect
04x0025	Minimum Running Time	R/W	16 bit	0	1000	Seconds. 0 = OFF => no effect
04x0026	Minimum Stopping Time	R/W	16 bit	0	1000	Seconds. 0 = OFF => no effect
04x0027	Maximum Start Speed	R/W	16 bit	0	10000	RPM. 0 = OFF => no effect
04x0028	Minimum Start Speed	R/W	16 bit	0	10000	RPM. 0 = OFF => no effect

Modbus Default Werte (values) E1045R + E1045DP

Reg. Adr.	Beschreibung	Data descrition	Default Motor 1	Default Motor 2	Default Motor 3	Default Motor 4	Default Motor 5	Default Motor 6	Default Motor 7
			BSA804	ASD084	ASC092	ASD102	ASD104	ASG133C	ASG133S
04x0000	Geschwindigkeits Setpunkt	Speed setpoint	0	0	0	0	0	0	0
04x0001	Geschwindigkeits Setpunkt Typ	Speed setpoint Type	0	0	0	0	0	0	0
04x0002	Set Richtung. Nicht einstellbar für	Set direction. Not	1	1	1	1	1	1	1
04x0003	Minimum Geschwindigkeit	Minimum speed	2400	1600	1600	1600	1600	1600	1600
04x0004	Maximum Geschwindigkeit	Maximum speed	6000	6000	6000	6000	6000	6000	6000
04x0005	Ramp up Zeit	Ramp up time	30	30	30	30	30	30	30
04x0006	Ramp down Zeit	Ramp down time	30	30	30	30	30	30	30
04x0007	Stop oder Run bei min.	Stop or run at min	0	0	0	0	0	0	0
04x0008	Externes Geschwindigkeit und	External Speed and	1	1	1	1	1	1	1
04x0009	Externes minimal	External min. speed	10	10	10	10	10	10	10
04x0010	Externes maximal	External max. speed	100	100	100	100	100	100	100
04x0011	Externe Stop Spannung	External stop voltage.	5	5	5	5	5	5	5
04x0012	Externer Richtungs Input	External direction input	0	0	0	0	0	0	0
04x0013	Relais Ausgangsfunktion	Relay output function	3	3	3	3	3	3	3
04x0014	Automatischer Neustart bei	Auto restart at error	5	5	5	5	5	5	5
04x0015	Zeitverzögerung Automatischer	Auto restart delay time	20	20	20	20	20	20	20
04x0016	Stromlimit, Betriebsstrom	Current limit. Running	450	400	500	500	500	500	500
04x0017	Stromlimit, Startstrom	Current limit. Starting	500	800	800	800	800	800	800
04x0018	Stromlimit, Abschaltstrom	Current limit. Breaking	0	0	0	0	0	0	0
04x0019	Automatische	Auto speed reduce	1	1	1	1	1	1	1
04x0020	VHZ zunahme	VHZ_Gain	0	0	0	0	0	0	0
04x0021	VHZ Boost	VHZ_Boost	0	0	0	0	0	0	0
04x0022	VHZ modlim	VHZ_modlim	0	0	0	0	0	0	0
04x0023	Temperatur Reduzier Limit	TempReduceLimit	87	87	87	87	87	87	87
04x0024	Start Stop Vorgangs Limit pro Stunde	Start stop times per hour	6	6	10	6	6	10	10
04x0025	Minimum Laufzeit	Minimum Running Time	180	180	180	180	180	180	180
04x0026	Minimum Stop Zeit	Minimum Stopping Time	180	180	180	180	180	180	180
04x0027	Maximale Start Geschwindigkeit	Maximum Start Speed	3600	3600	3600	3600	3600	3600	3600
04x0028	Minimale Start Geschwindigkeit	Minimum Start Speed	2200	2200	2200	2200	2200	2200	2200

Diese Werte sind auf die Erfordernisse der entsprechenden Verdichter abgestimmt. Veränderung erfolgen auf eigenes Risiko und/oder sollten mit uns abgestimmt werden!

These Default data are implemented based on the requirments of the compressor in question. Changing these data is on your own risk and/or should be discussed with us.!

Holding Register Description

04x0000: "Speed setpoint"
The register is used to set the motor speed.
The motor is always stopped if "Speed setpoint" is lower than minimum speed (see 04x0003).
Note: This register is only active if register 04x0008 is set to 0.
If 04x0001 is set to 0, the speed is set in rpm.
If 04x0001 is set to 1, the speed is set in %. (0%=min. rpm and 100%=max. rpm)

04x0001: "Speed setpoint Type"
This register is used to choose whether "Speed setpoint" (04x0000) is specified in rpm or %.
If set to 0, the rpm has been chosen.
If set to 1, the % has been chosen.

04x0002: "Set direction"
This register is used to choose whether the motor is to run CCW or CW.
If set to 0, CCW has been chosen.
If set to 1, CW has been chosen.
Note: The register is only active if register 04x0012 is set to 0.
The register only alters the direction when the motor is at a still stand.

04x0003: "Minimum speed"
This register is used to choose the minimum speed for the motor in rpm.
If a speed lower than the absolute minimum speed of the motor is chosen, the speed will never be regulated lower than the absolute minimum speed.
For further information on minimum speed of the motor, please consult the specifications of the motor in question.

04x0004: "Maximum speed"
This register is used to choose the maximum speed for the motor in rpm.
If a speed higher than the absolote maximum speed of the motor is chosen, the speed will never be regulated higher than the absolute maximum speed.
For further information on maximum speed of the motor, please consult the specifications of the motor in question.

04x0005: "Ramp up time"
This register is used to choose how fast the speed accelerates from min to max in seconds.
However, it is not possible to regulate faster than the internal ramp up time (eg. max 100rpm/second).

04x0006: "Ramp down time"
This register is used to choose how fast the speed is turned down from max to min in seconds.
However, it is not possible to regulate faster than the internal ramp time (eg. max 100rpm/second).

04x0007: "Run or stop at min speed"
This register is used to choose whether the motor should stop or run at minimum speed if asked to run below minimum speed. This is only valid if the control signal is a 0 – 10V signal.
If set to 0, stop is choosen.
If set to 1, minimum speed is choosen.

04x0008: "External Speed and RUN signal"
This register is used to choose that the motor is controlled by the external 0 - 10V signal and the RUN signal.
If set to 0, the control is according to modbus settings.
If set to 1, the control is according to the external 0 – 10V signal and RUN signal.

04x0009: "External min. speed voltage"
This register is used to set the voltage of the minimum speed by means of the 0 – 10 V signal. Note that 10 correspond to 1,0V.
Note: The register is only active if register 04x0008 is set to 1.

04x00010: "External max. speed voltage"
This register is used to set the voltage of the maximum speed by means of the 0 – 10 V signal. Note that 90 correspond to 9,0V.
Note: The register is only active if register 04x0008 is set to 1.

04x00011: "External stop voltage"
This register is used to set the voltage level at which the motor should stop by means of the 0 – 10 V signal. If the control voltage decreases to this level or a lower level, the motor will stop. Note that 5 corresponds to 0,5V.
Note: The register is only active if register 04x0007 is set to 0 and 04x0008 is set to 1.

04x00012: "External direction input enabled"
This register is used to set the frequency converter to be controlled via the external DIR signal.
If set to 0, the control is according to modbus settings.
If set to 1, the control is according to the external DIR signal.

04x00013: "Relay output function"
This register is used to choose how the alarm relay is to function.
If set to 0: Relay is OFF all the time.
If set to 1: Relay is ON in ready state.
If set to 2: Relay is ON when motor is running.
If set to 3: Relay is ON in case of error.
If set to 4: Relay is ON, no error.

04x00014: "Auto restart at error times"
This register is used to set how many times within 24 hours the frequency converter is allowed to try to restart after an error.
If set to 0: OFF. The frequency converter will not attempt automatic restart.
If set to 1-50: Number of times automatic restart may be attempted within 24 hours before the alarm is activated.

04x00015: "Auto restart delay time"
This register is used to choose how long the frequency converter should wait before attempting to restart after having registered an error. The time is set in seconds.
Note: If the value in register 04x0026 is higher than 0, 04x0015 must always be higher than
the value in 04x0026.
If the value in 04x0015 is set to a lower value than the one in 04x0026, the controller automatic sets the value equal to the value in 04x0026.

04x00016: "Current limit. Running current"
This register is used to set the maximum current which the motor should not exceed in operation.
At PMSM/BLDC motors the speed wil be regulated to a lower speed when the limit is reached, but never lower than the minimum speed.
At ACIM motors the down regulation function can be deactivated (Register 04x0019) and the motor will stop if the current exceeds the limit. The time until the motor stops depends on the current and the excess time. Otherwise the speed is regulated to a lower speed in ACIM.
Note 200 correspond to 2,00A.

04x00017: "Current limit. Starting current"
This register is used to set the current at which the motor will start. This register is only used for PMSM / BLDC motors. For ACIM motors, this feature has no function.
Note 200 correspond to 2,00A.

04x00018: "Current limit. Breaking current"
This register is used to set the current which the motor is allowed to receive during braking. This register is only active for PMSM / BLDC motors and if the chosen motor profile supports the use of a special brake function. For ACIM motors, this feature has no function.
Note 200 correspond to 2,00A.

04x00019: "Auto speed reduces before current limit"
This register is used to set whether the ACIM motor should be reduced in speed or stopped if the limit for running current is exceeded. Not used for PM motors.
If set to 0 : The motor is stopped when the limit is exceeded.
If set to 1 : The motor speed is lowered as long as the limit is exceeded.

04x00020: "VHZ_Gain"
This register has no function.

04x00021: ”VHZ_Boost”
This register has no function.

04x00022: ”VHZ_ModLim”
This register has no function.

04x00023: ”TempReduceLimit”
This register is used to set at which temperature (on the power module surface) the speed should be down regulated to protect the frequency converter.

04x00024: ”Start stop times per hour”
This register is used to set how often the motor is allowed to start and stop within an hour.

If set to 0:	This register will be ignored.
If set to 1 - 20:	It is only possible to start and stop the motor the set number of times within an hour.

04x00025: ”Minimum Running Time”
This register is used to set the minimum time period (in seconds), the motor must run before it can be stopped. Used for e.g. compressor operation.

If set to 0:	This register will be ignored.
If set to 1 - 1000:	The motor will at minimum run the set number of seconds.

04x00026: ”Minimum Stopping Time”
This register is used to set the minimum time period (in seconds), the motor must be at a still stand before it can be started again. Used for e.g. compressor operation.

If set to 0:	This register will be ignored.
If set to 1 - 60:	The motor will be stopped for 60 seconds.
If set to 61 - 1000:	The motor will be stopped for the given number of seconds.

04x00027: ”Maximum Start RPM”
This register is used to set the maximum speed the motor can run at startup in the given time ”Minimum Stopping Time” (register 04x0025). Used especially for compressor operation.

If set to 0:	This register will be ignored.
If set to 1 - 10000:	The maximum speed at which the motor can start.

04x00027: ”Minimum Start RPM”
This register is used to set the minimum speed the motor can run at startup in the given time ”Minimum Stopping Time” (register 04x0025). Used especially for compressor operation.

If set to 0:	This register will be ignored.
If set to 1 - 10000:	The maximum speed at which the motor can start.

Input Register

Using modbus it is possible to obtain a wide range of information on the status of the entire system. The values below are exported from the modbus registers.

Input Register Overview

Reg. Adr.	Data beskrivelse	R/W	Lengh	Min.	Max.	Remark
03x0000	Speed target	R	16 bit	0	10000	RPM
03x0001	Speed measured	R	16 bit	0	10000	RPM
03x0002	External speed signal	R	16 bit	0	100	Volt. 10 correspond to 1,0V.
03x0003	External LSC signal	R	16 bit	0	1	0 = open / 1 = closed
03x0004	External DIR signal	R	16 bit	0	1	0 = open / 1 = closed
03x0005	External RUN signal	R	16 bit	0	1	0 = open / 1 = closed
03x0006	External ALARM Relay	R	16 bit	0	1	0 = open / 1 = closed
03x0007	Temperature powermodule	R	16 bit	0	120	°C. Cannot show less than 28.
03x0008	Temperature cabinet	R	16 bit	0	120	°C.
03x0009	Error Code	R	16 bit	0	65535	
03x0010	Error Code2	R	16 bit	0	65535	
03x0011	Fatal FOF error	R	16 bit	0	1	
03x0012	Status Code	R	16 bit	0	65535	
03x0013	Hour counter	R	16 bit	0	65535	Hour.
03x0014	DC voltage	R	16 bit	0	1000	Volt.
03x0015	Motor current	R	16 bit	0	2000	Ampere. 200 = 2,00A.
03x0016	Model number	R	16 bit	0	1000	
03x0017	Rated Motor Current	R	16 bit	0	2000	Ampere. 200 = 2,00A
03x0018	VoltageMotorAC	R	16 bit	0	1000	Volt.
03x0019	Number of restarts	R	16 bit	0	65535	
03x0020	Dip switch position	R	16 bit	0	65535	Only shows a number from 0 to 15.

Reg. Adr.	Data description	R/W	Lengh	Min.	Max.	Remark
03x0100	Hours at temperature 0 to 10	R	16 bit	0	65535	Hours
03x0101	Hours at temperature 10 to 20	R	16 bit	0	65535	Hours
03x0102	Hours at temperature 20 to 30	R	16 bit	0	65535	Hours
03x0103	Hours at temperature 30 to 40	R	16 bit	0	65535	Hours
03x0104	Hours at temperature 40 to 50	R	16 bit	0	65535	Hours
03x0105	Hours at temperature 50 to 60	R	16 bit	0	65535	Hours
03x0106	Hours at temperature 60 to 70	R	16 bit	0	65535	Hours
03x0107	Hours at temperature 70 to 80	R	16 bit	0	65535	Hours
03x0108	Hours at temperature 80 to 90	R	16 bit	0	65535	Hours
03x0109	Hours at temperature 90 to 100	R	16 bit	0	65535	Hours
03x0110	Hours at temperature 100 to 110	R	16 bit	0	65535	Hours

Reg. Adr.	Data description	R/W	Lengh	Min.	Max.	Remark
03x0120	Hour count current 0 – 1A	R	16 bit	0	65535	Hours
03x0121	Hour count current 1 – 2A	R	16 bit	0	65535	Hours
03x0122	Hour count current 2 – 3A	R	16 bit	0	65535	Hours
03x0123	Hour count current 3 – 4A	R	16 bit	0	65535	Hours
03x0124	Hour count current 4 – 5A	R	16 bit	0	65535	Hours
03x0125	Hour count current 5 – 6A	R	16 bit	0	65535	Hours
03x0126	Hour count current 6 – 7A	R	16 bit	0	65535	Hours
03x0127	Hour count current 7 – 8A	R	16 bit	0	65535	Hours
03x0128	Hour count current 8 – 9A	R	16 bit	0	65535	Hours
03x0129	Hour count current 9 – 10A	R	16 bit	0	65535	Hours

Reg. Adr.	Data description	R/W	Lengh	Min.	Max.	Remark
03x0200	Pic Controller Version	R	16 bit	0	1000	10 = 1,0
03x0201	Pic Controller Subversion	R	16 bit	97	122	97 = 'a' , 98 = 'b' etc.
03x0202	Modbus Version	R	16 bit	0	1000	10 = 1,0
03x0203	Modbus Subversion	R	16 bit	97	122	97 = 'a' , 98 = 'b' etc.
03x0204	IR MCE Software Version	R	16 bit	0	1000	1xx = ACIM V.xx, / 2xx = PMSM V.xx,
03x0205	IR LSC Software Version	R	16 bit	0	1000	10 = 1,0

Reg. Adr.	Data beskrivelse	R/W	Lengh	Min.	Max.	Remark
03x0300	Debug Value 1	R	16 bit	0	65535	Not in use
03x0301	Debug Value 2	R	16 bit	0	65535	Not in use
03x0302	Debug Value 3	R	16 bit	0	65535	Not in use
03x0303	Debug Value 4	R	16 bit	0	65535	Not in use
03x0304	Debug Value 5	R	16 bit	0	65535	Not in use
03x0305	Debug Value 6	R	16 bit	0	65535	Not in use
03x0306	Debug Value 7	R	16 bit	0	65535	Not in use
03x0307	Debug Value 8	R	16 bit	0	65535	Not in use
03x0308	Debug Value 9	R	16 bit	0	65535	Not in use
03x0309	Debug Value 10	R	16 bit	0	65535	Not in use
03x0310	Debug Value 11	R	16 bit	0	65535	Not in use
03x0311	Debug Value 12	R	16 bit	0	65535	Not in use
03x0312	Debug Value 13	R	16 bit	0	65535	Not in use
03x0313	Debug Value 14	R	16 bit	0	65535	Not in use
03x0314	Debug Value 15	R	16 bit	0	65535	Not in use
03x0315	Debug Value 16	R	16 bit	0	65535	Not in use

Input Register Description

03x0000: "Speed target"
This register shows the target speed according to which the speed is regulated.

03x0001: "Speed measured"
The register is used to monitor the current motor speed.

03x0002: "External speed signal"
This register is used to monitor the voltage on the 0-10V input.
Note that 70 corresponds to 7,0V

03x0003: "External LSC signal"
This register is used to monitor the LSC input. Note that LSC is active in low.

Show 0: The LSC input is not active. (not connected at all)
Show 1: The LSC input is active. (connected to GND)

03x0004: "External DIR signal"
This register is used to monitor the DIR input. Note DIR is active in low.
Show 0: The DIR input is not active. (not connected at all)
Show 1: The DIR input is active. (connected to GND)

03x0005: "External RUN signal"
This register is used to monitor the RUN input. Note RUN is active in low.
Show 0: The RUN input is not active. (not connected at all)
Show 1: The RUN input is active. (connected to GND)

03x0006: "External ALARM Relay"
This register is used to monitor the status of the alarm relay.
Show 0: The alarm relay is off.
Show 1: The alarm relay is on.
Note: The function of the alarm relay is set in register 04x00113.

03x0007: "Temperature power module"
This register shows the surface temperature on the power module.

03x0008: "Temperature cabinet"
This register shows the temperature on the PCB.

03x0009: "Error Code"
This register is used for regristration of errors.
See page 11 for description of error types.

03x0010: "Error Code2"
This register is used for registration of errors.
See page 11 for description of error types.

03x0011: "Fatal FOF error"
This register is used for monitoring of fatal errors.
Show 0: No fatal error has occured.
Show 1: A fatal error has occured the control must be restarted manually.

03x0012: ”Status code”
This register shows the status of the controller.

Show 0:	Corresponds to ”Idle”. The motor is not running. Everything is OK. Awaiting start.
Show 1:	Corresponds to ”Run”. The motor is running. Everything is OK.
Show 2:	Corresponds to ”Fault”. The motor is not running. An error has been detected.

03x0013: ”Hour counter”
This register is used for accumulation of the number of hours the controller has been in operation – hours where the motor has been running.

03x0014: ”DC Voltage”
This register is used for monitoring of the intermediate circuit voltage. 300 = 300VDC.

03x0015: ”Motor current”
This register is used for monitoring of the running current of the motor.
This value is directly read for PMSM/BLDC motors. 200 = 2,00A.
For ACIM motors it can also be directly read, but only at higher currents.

03x0016: ”Model number”
This register holds information on selected motors.
See page 12 for information on selection of motor.

03x0017: ”Rated Motor Current”
This register shows the rated current of the selected motor. 200 = 2,00A.

03x0018: ”VoltageMotorAC”
This register used for monitoring of the voltage supplied to the motor (approximately).

03x0019: ”Number of restarts”
This register shows the accumulted number of restarts.

03x0020: ”Dip switch position”
This register shows the positions of the Dip switches. Value from 0 to 15.

03x0100: ” Hours at temperature 0 to 10”
This register shows the number of hours the power module has been exposed to temperatures between 0°C to 10°C.

03x0101: ” Hours at temperature 10 to 20”
The register shows the hours where the power module has been from 10°C to 20°C.

03x0102: ” Hours at temperature 20 to 30”
The register shows the hours where the power module has been from 20°C to 30°C.

03x0103: ” Hours at temperature 30 to 40”
This register shows the number of hours the power module has been exposed to temperatures from 30°C to 40°C.

03x0104: ” Hours at temperature 40 to 50”
This register shows the number of hours the power module has been exposed to temperatures from 40°C to 50°C.

03x0105: ” Hours at temperature 50 to 60”
This register shows the number of hours the power module has been exposed to temperatures from 50°C to 60°C.

03x0106: ” Hours at temperature 60 to 70”
This register show the number of hours the power module has been exposed to temperatures from 60°C to 70°C.

03x0107: ” Hours at temperature 70 to 80”
This register shows the hours where the power module has been from 70°C to 80°C.

03x0108: ” Hours at temperature 80 to 90”
This register shows the number of hours the power module has been exposed to temperatures from 80°C to 90°C.

03x0109: ” Hours at temperature 90 to 100”
This register shows the number of hours the power module has been exposed to temperatures from 90°C to 100°C.

03x0110: ” Hours at temperature 100 to 110”
This register shows the number of hours the power module has been exposed to temperatures from 100°C to 110°C.

03x0120: ” Hour count current 0 – 1A”
This register shows the number of hours the motor has pulled 0 – 1A.

03x0121: ” Hour count current 1 – 2A”
This register shows the number of hours the motor has pulled 1 – 2A.

03x0122: ” Hour count current 2 – 3A”
This register shows the number of hours the motor has pulled 2 – 3A.

03x0123: ” Hour count current 3 – 4A”
This register shows the number of hours the motor has pulled 3 – 4A.

03x0124: ” Hour count current 4 – 5A”
This register shows the number of hours the motor has pulled 4 – 5A.

03x0125: ” Hour count current 5 – 6A”
This register shows the number of hours the motor has pulled 5 – 6A.

03x0126: ” Hour count current 6 – 7A”
This register shows the number of hours the motor has pulled 6 – 7A.

03x0127: ” Hour count current 7 – 8A”
This register shows the number of hours the motor has pulled 7 – 8A.

03x0128: ” Hour count current 8 – 9A”
This register shows the number of hours the motor has pulled 8 – 9A.

03x0129: ” Hour count current 9 – 10A”
This register shows the number of hours the motor has pulled 9 – 10A.

03x0200: ”Pic Controller Version”
This register holds information on the software version of the controller circuit.
10 = Version 1,0.

03x0201: ”Pic controller Subversion”
This register holds the softvare subversion of the controller circuit.

03x0202: ”Modbus Version”
This register holds the software version of the Modbus circuit.
10 = Version 1,0.

03x0203: ”Modbus Subversion”
This register holds information on the software subversion of the Modbus circuit.
97 = ’a’, 98 = ’b’ etc.

03x0204: ”IR MCE Software Version”
This register holds information on the software version of the MCE core.
1xx = ACIM Version xx.
2xx = PMSM/BLDC Version xx.

03x0205: ”IR LSC Software Verion”
This register holds information on the sofware version of the power circuit.
10 = Version 1,0.

03x0300 – 03x0315 ”Debug Value 1” up to ”Debug Value 16”
These registers are only used for debugging and are of no importance to the user.

FAQ

No LEDs are on and the motor doesn't start.	1.) Check if the frequency converter is connected to mains 2.) Check if fuse is blown.

WEEE

Electrical and electronic equipment contains material which may be hazardous to human health and environment if it is not handled correctly at disposal.

Electrical and electronic equipment is marked with a crossed-out wheelie bin logo. This logo symbolizes that electrical and electronic equipment must not be disposed of together with normal household waste but must be collected separately.

Contact your local authorities for further information on disposal of equipment under the
WEEE directive.